GLACE-2

The 2nd phase of the Global Land-Atmosphere Coupling Experiment

Progress Report: December, 2008

Agenda:

-- Go over current progress amongst different groups and here at GLACE-2 Central

-- Discuss recently-found problem with SST boundary data

-- Discussion of schedules, etc.

Updated Participant List

Group/Model	# models	Points of Contact
1. NASA/GSFC (USA): GMAO seasonal forecast system (old and new)	2	R. Koster, T. Yamada
2. COLA (USA): COLA GCM, NCAR/CAM GCM	2	P. Dirmeyer, Z. Guo
3. Princeton (USA): NCEP GCM	1	E. Wood, L. Luo
4. IACS (Switzerland): ECHAM GCM	1	S. Seneviratne, A. Roesch
5. KNMI (Netherlands): ECMWF	1	B. van den Hurk
6. ECMWF	1	G. Balsamo
7. GFDL (USA): GFDL system	1	T. Gordon
8. U. Gothenburg (Sweden): NCAR	1	J.-H. Jeong
9. CCSR/NIES/FRCGC (Japan): CCSR GCM	1	T. Yamada
10. FSU/COAPS	1	M. Boisserie
	12 models	

Fcst. Model	*Points of Contact*	*Progress to Date*
COLA GCM ; NCAR/ CAM GCM, via COLA	Paul Dirmeyer, Zhichang Guo	-- Forcing data interpolated to proper resolution; offline land simulations proceeding. -- *Completed 10 years of COLA runs* -- NCAR runs being set up.

Three analyses performed here at GLACE-2 Central on COLA results:

1. Analysis of potential predictability.

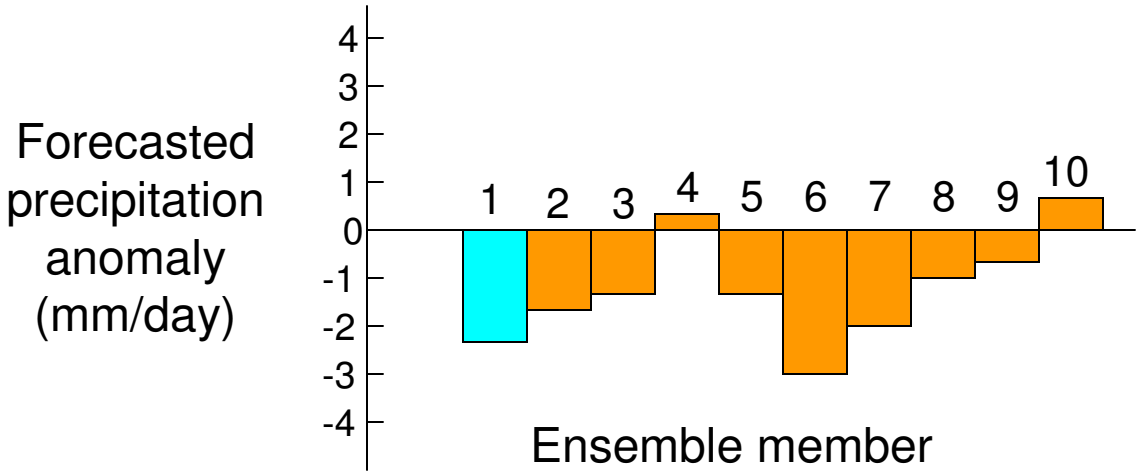
2. Analysis of forecast skill.

3. Analysis of forecast skill, using statistical enhancements.

Potential predictability is the *maximum* predictability possible in the forecasting system.

STEP 1: For a given ensemble forecast, assume that the first ensemble member represents "nature".

STEP 2: Assume that the remaining ensemble members represent the "forecast".

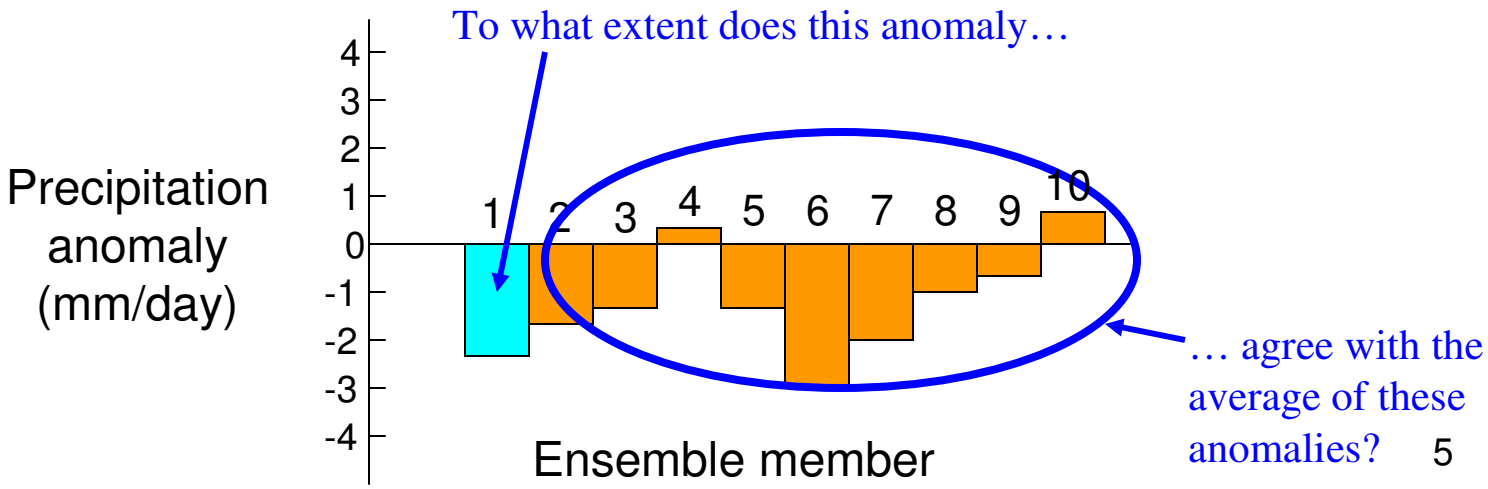


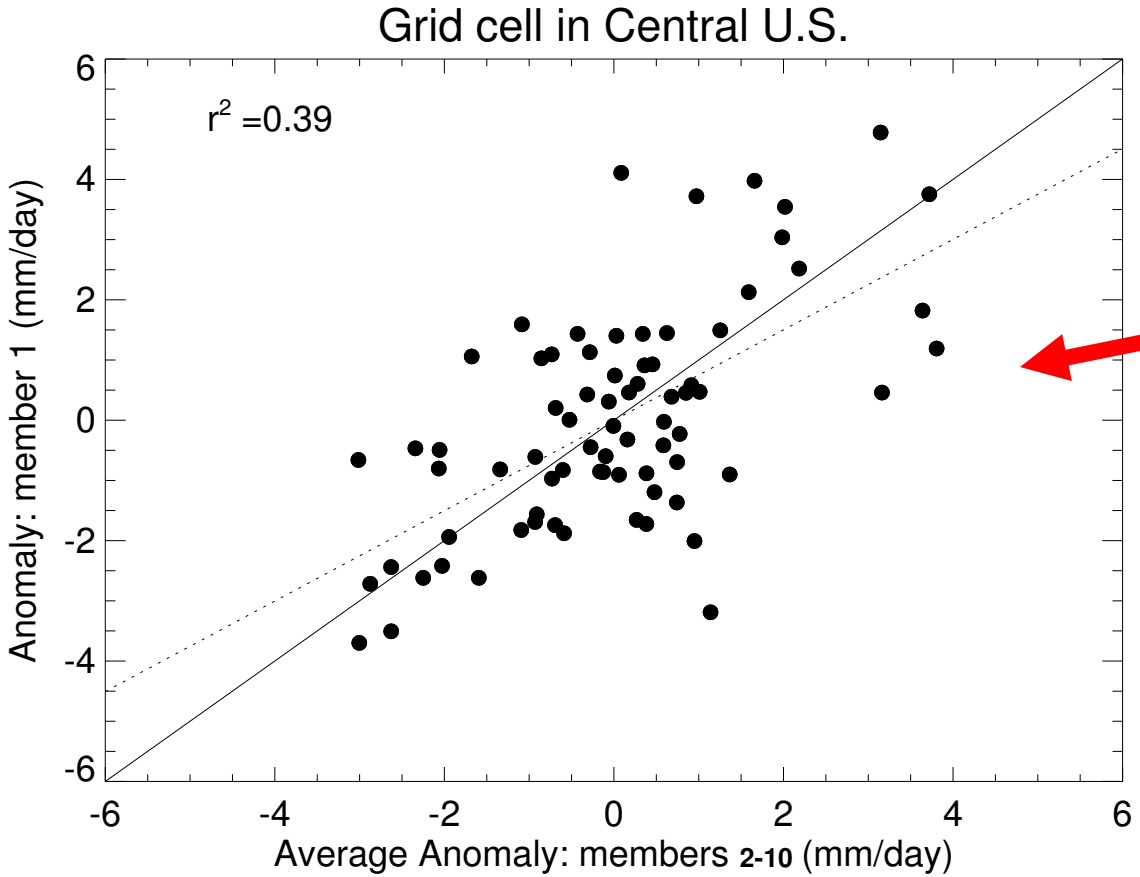
Potential predictability is the *maximum* predictability possible in the forecasting system.

STEP 1: For a given ensemble forecast, assume that the first ensemble member represents "nature".

STEP 2: Assume that the remaining ensemble members represent the "forecast".

STEP 3: Determine the degree to which the "forecast" agrees with the assumed "nature".





Regress "forecast" against "observations" to retrieve r^2, our measure of forecast skill.

Potential predictability is the *maximum* predictability possible in the forecasting system.

STEP 1: For a given ensemble forecast, assume that the first ensemble member represents "nature".

STEP 2: Assume that the remaining ensemble members represent the "forecast".

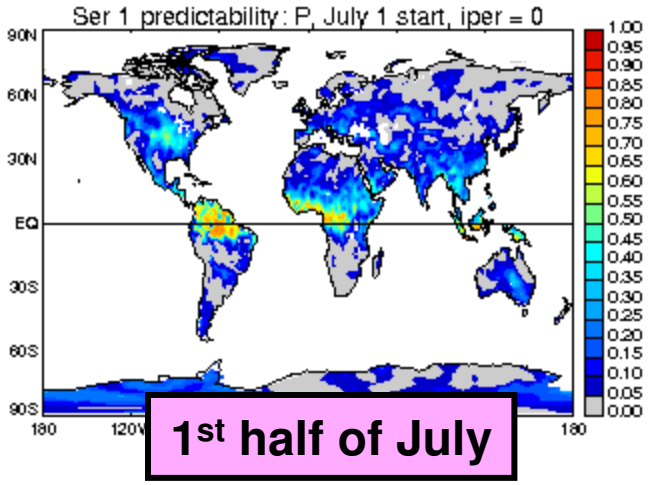
STEP 3: Determine the degree to which the "forecast" agrees with the assumed "nature".

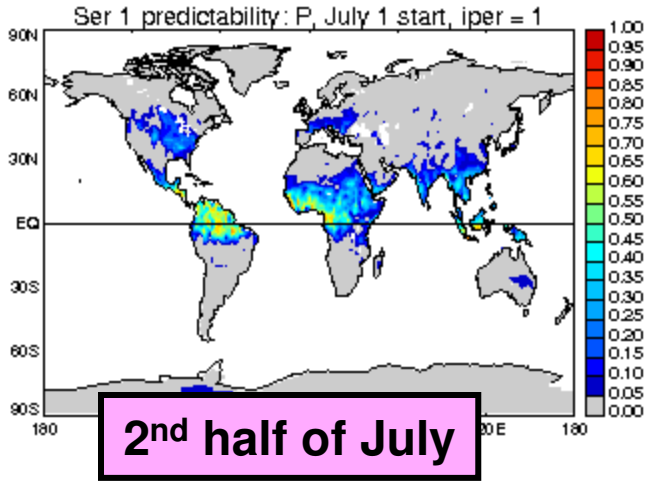
STEP 4: Repeat multiple times, with each ensemble member in turn taken as "nature". Average the resulting skill diagnostics.

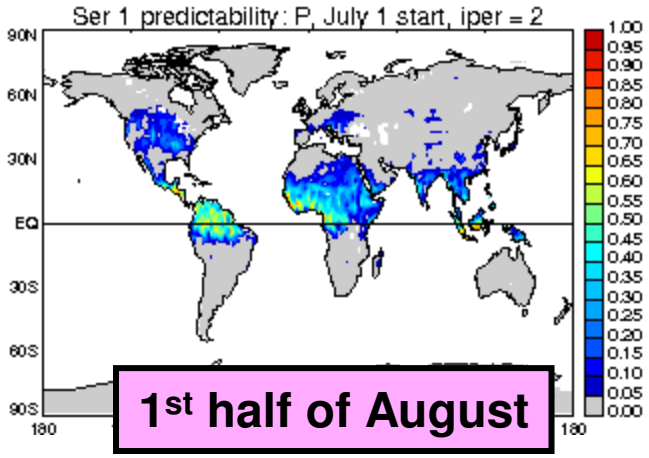
This analysis effectively determines the degree to which atmospheric chaos foils the forecast, under the assumptions of "perfect" initialization, "perfect" validation data, and "perfect" model physics. The potential predictability is an underlying characteristic of a modeling system that underlies its ability to perform in any forecast exercise.

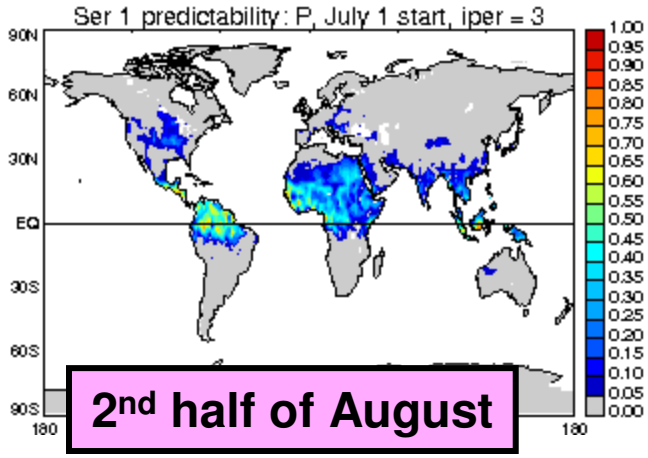
Potential Predictability (r^2), Precipitation (COLA model, Series 1)

(July 1 start, land initialized)



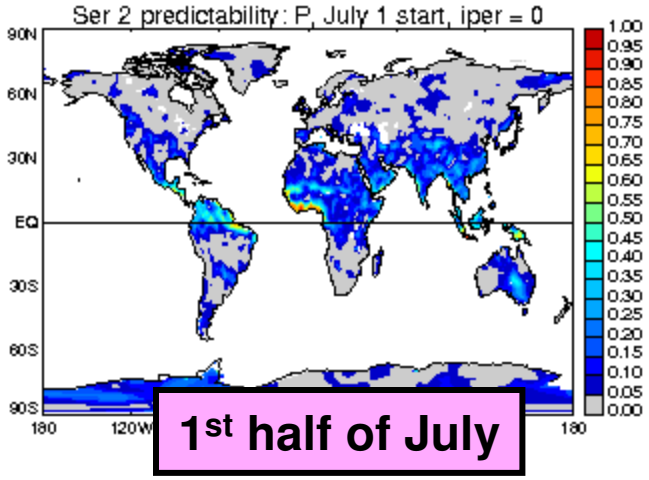


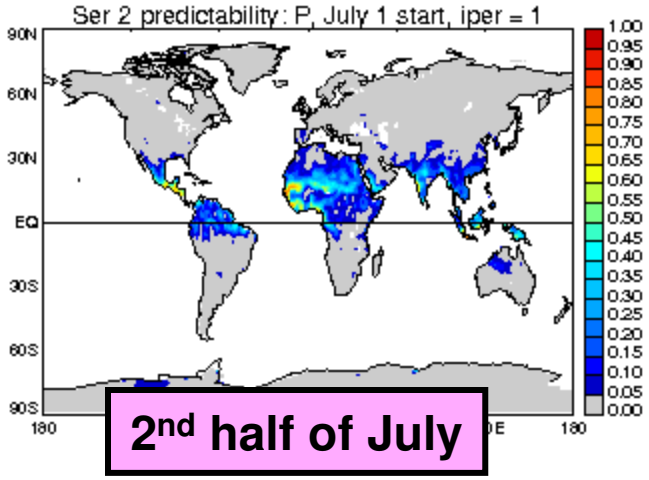


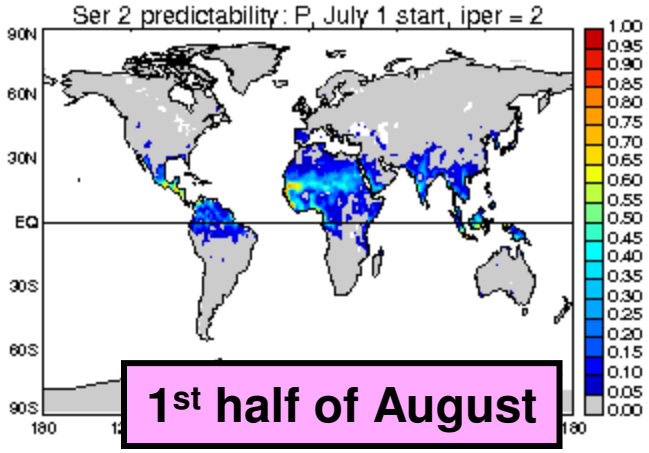


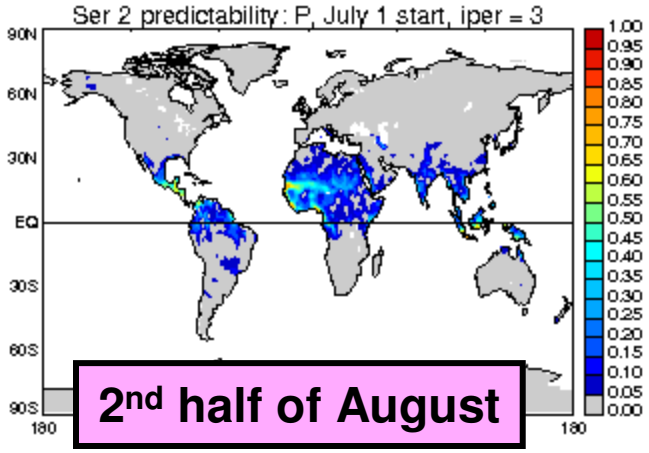
Potential Predictability (r^2), Precipitation (COLA model, Series 2)

(July 1 start, land initialized)



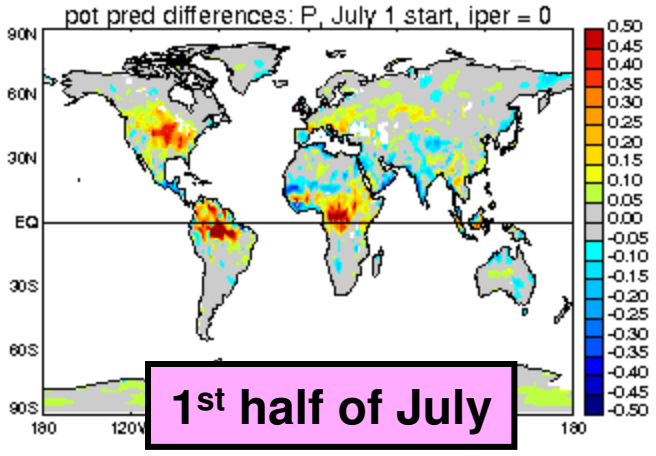


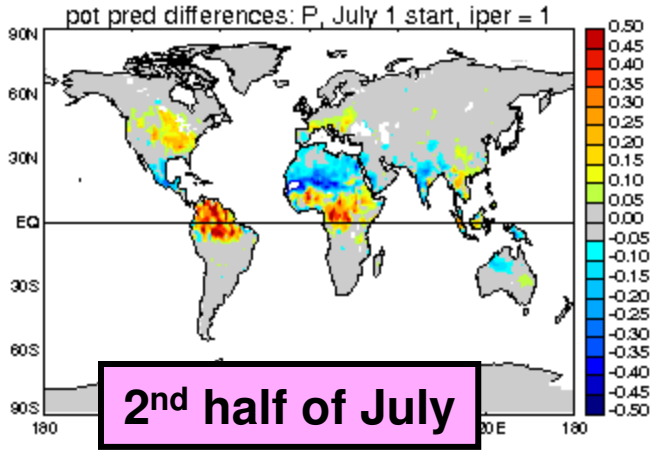


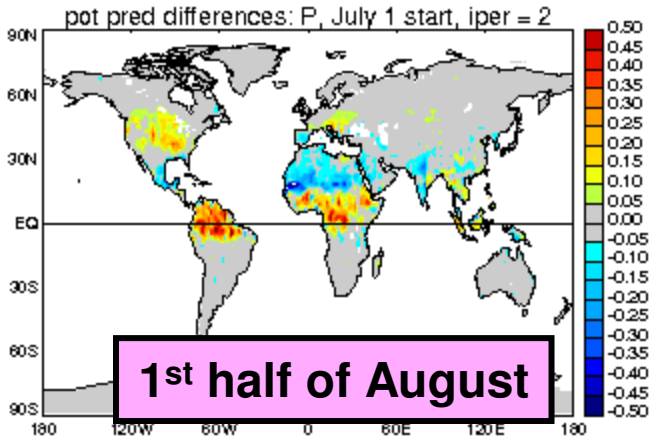


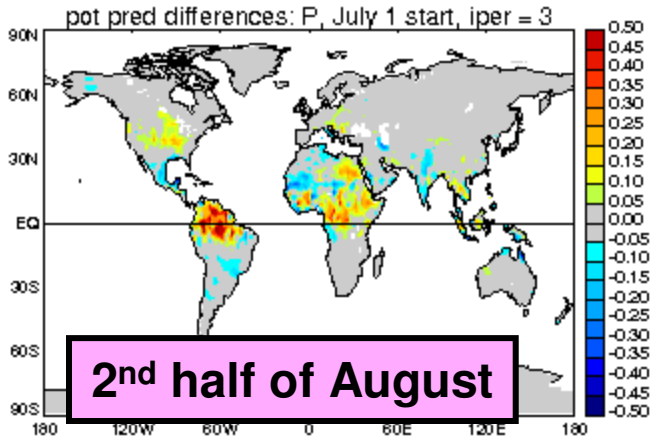
Net land impact on Potential Predictability (r^2), Precipitation (COLA model, Ser1 – Ser2)

(July 1 start, land initialized)









Forecast Skill: COLA model

Notes:

Skill is averaged separately for four leads:

a. 1-15 days after forecast start date
b. 16-30 days after forecast start date
c. 31-45 days after forecast start date
d. 46-60 days after forecast start date

For a given forecast start date and lead, the forecasts from the 10 ensemble members are averaged into a single field.

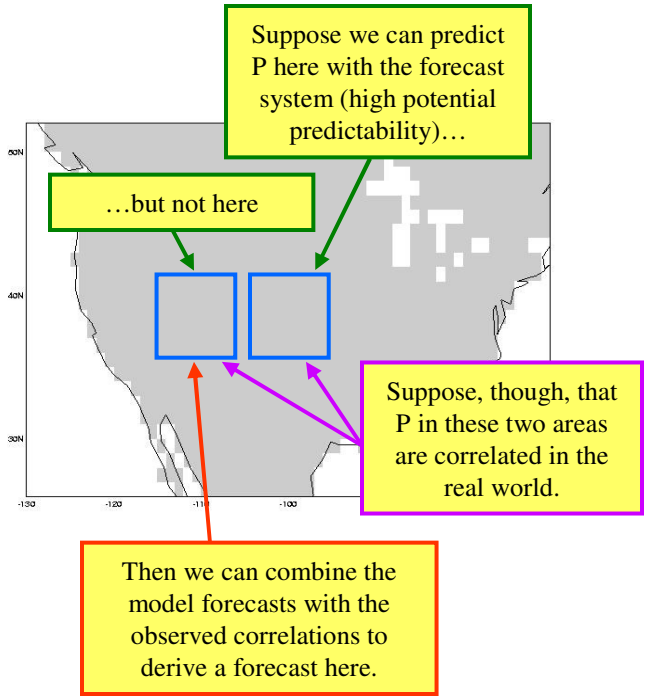
Skill for a given period is compared to observations during that period. (Measured as r^2.) Analysis focuses on US first, out of convenience: we have access to a high quality multi-decade observational dataset there (Higgins et al., 2000), and besides, most models show some coupling strength there (GLACE-1).

Prior to computing the skill scores (observations), all 15-day forecasts are standardized (using relevant means and standard deviations for given start date and lead), as are all the observations.

Forecast Skill: COLA model

Notes (continued):

The skill analysis is supplemented with an analysis of transformed forecasts:



Using these ideas, we can compute a "transformation matrix" **A** that improves a forecast:

$$\tilde{\mathbf{x}} = \mathbf{A}\,\mathbf{x}$$

Vector holding transformed forecasts

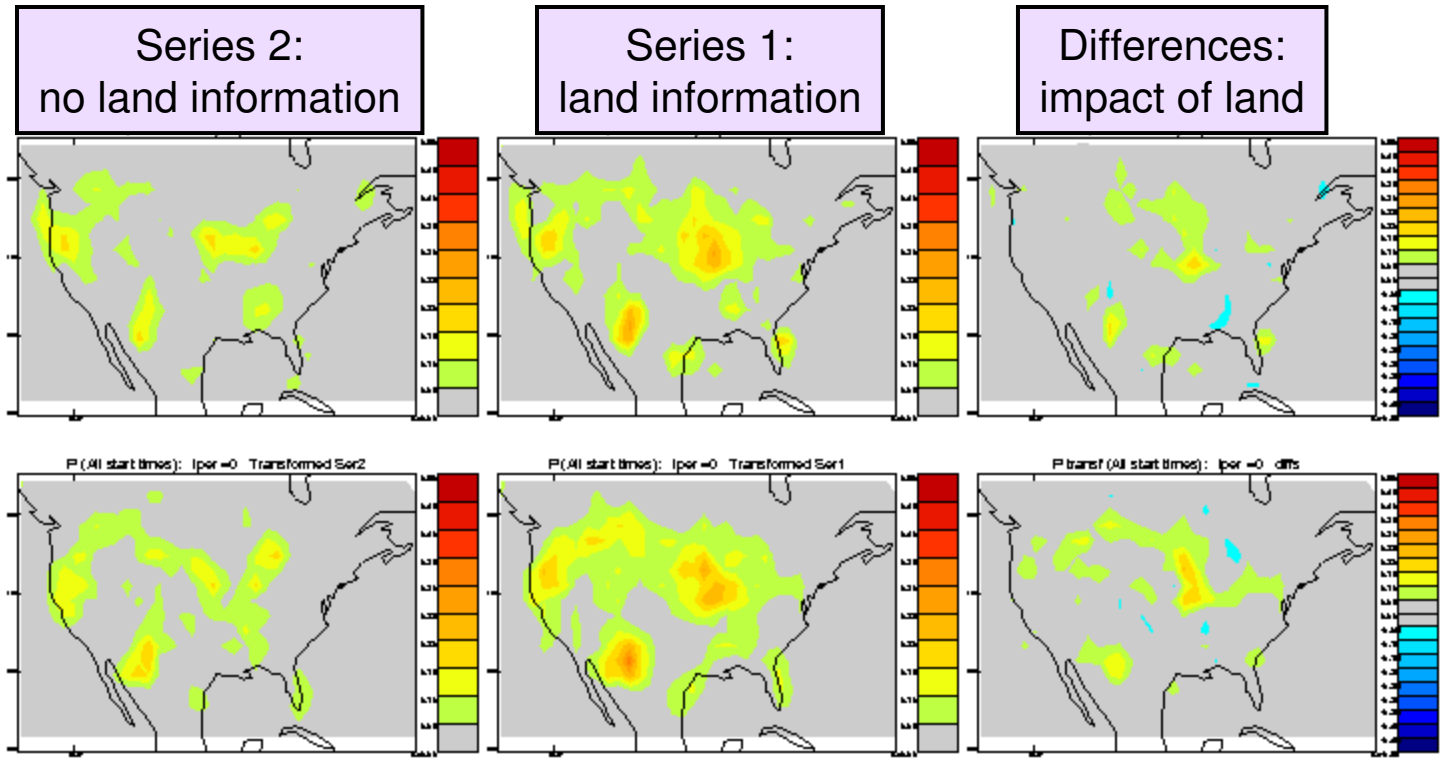
Vector holding original forecasts

For details, see Koster et al., *Monthly Weather Review*, **136**, p. 1923-1939.

Forecast skill (COLA): Precipitation

All start dates (100 standardized values going into r^2 calculation).

Lead: Days 1-15



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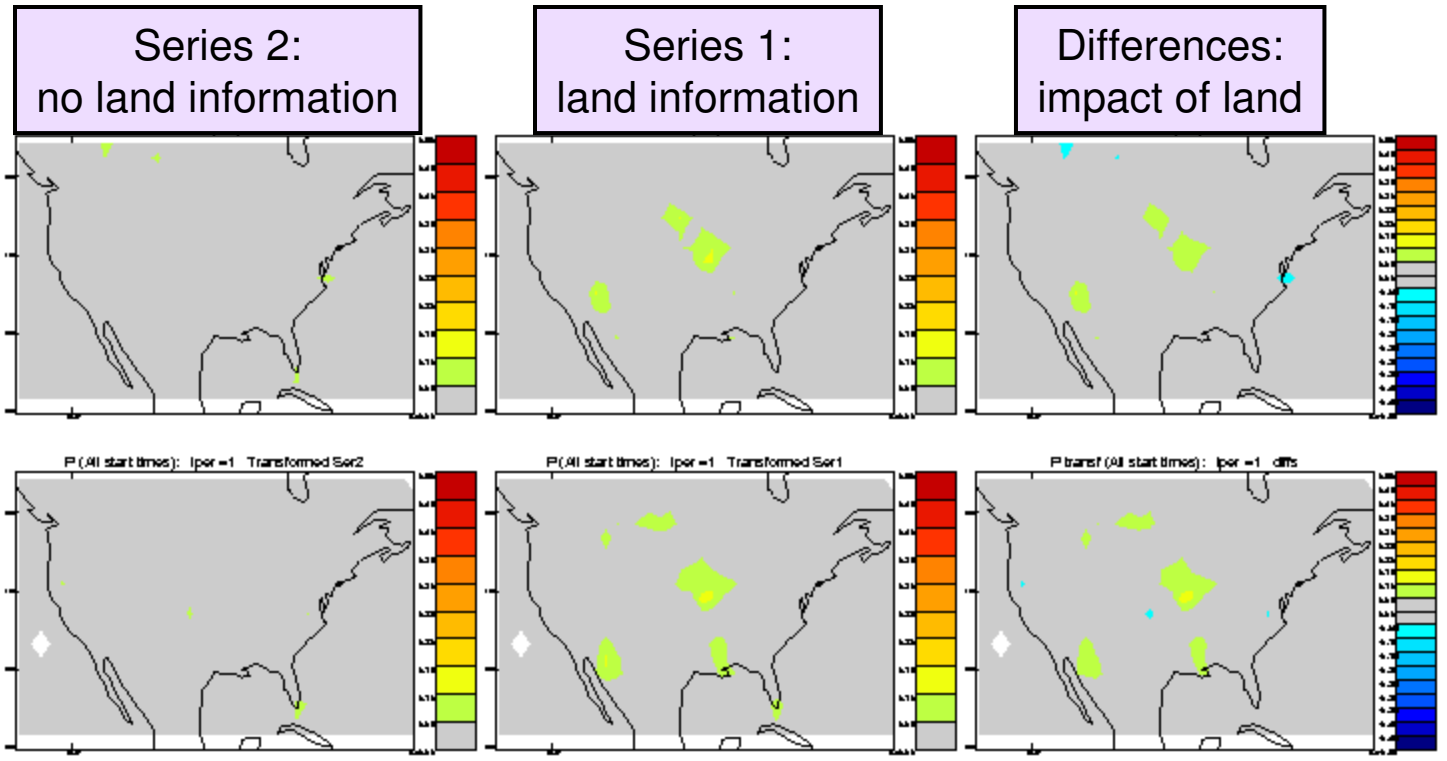
(colors go from -0.5 to 0.5)

Forecast skill (COLA): Precipitation

All start dates (100 standardized values going into r^2 calculation).

Lead: Days 15-30



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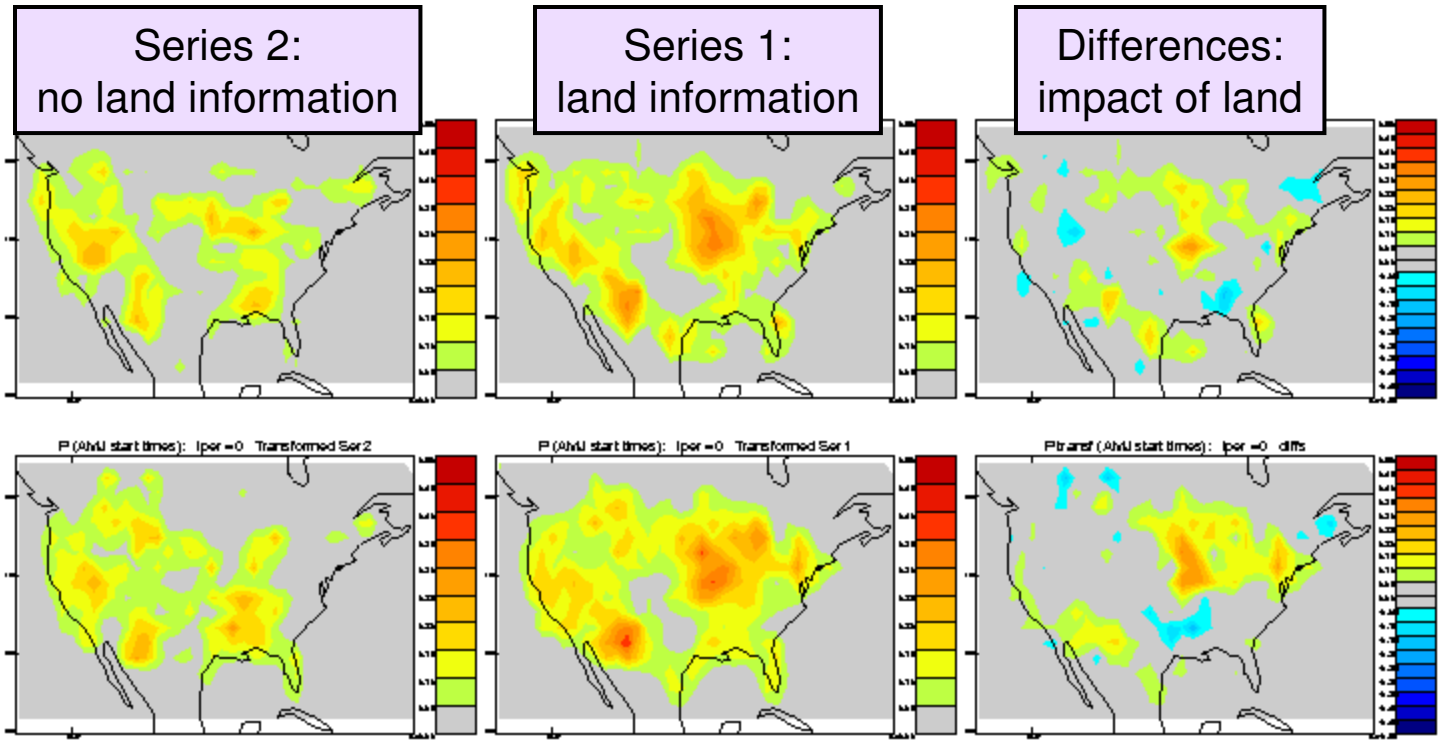
Forecast skill (COLA): Precipitation

AMJ start dates (60 standardized values going into r^2 calculation).
Lead: Days 1-15



(colors go from 0. to 0.5)

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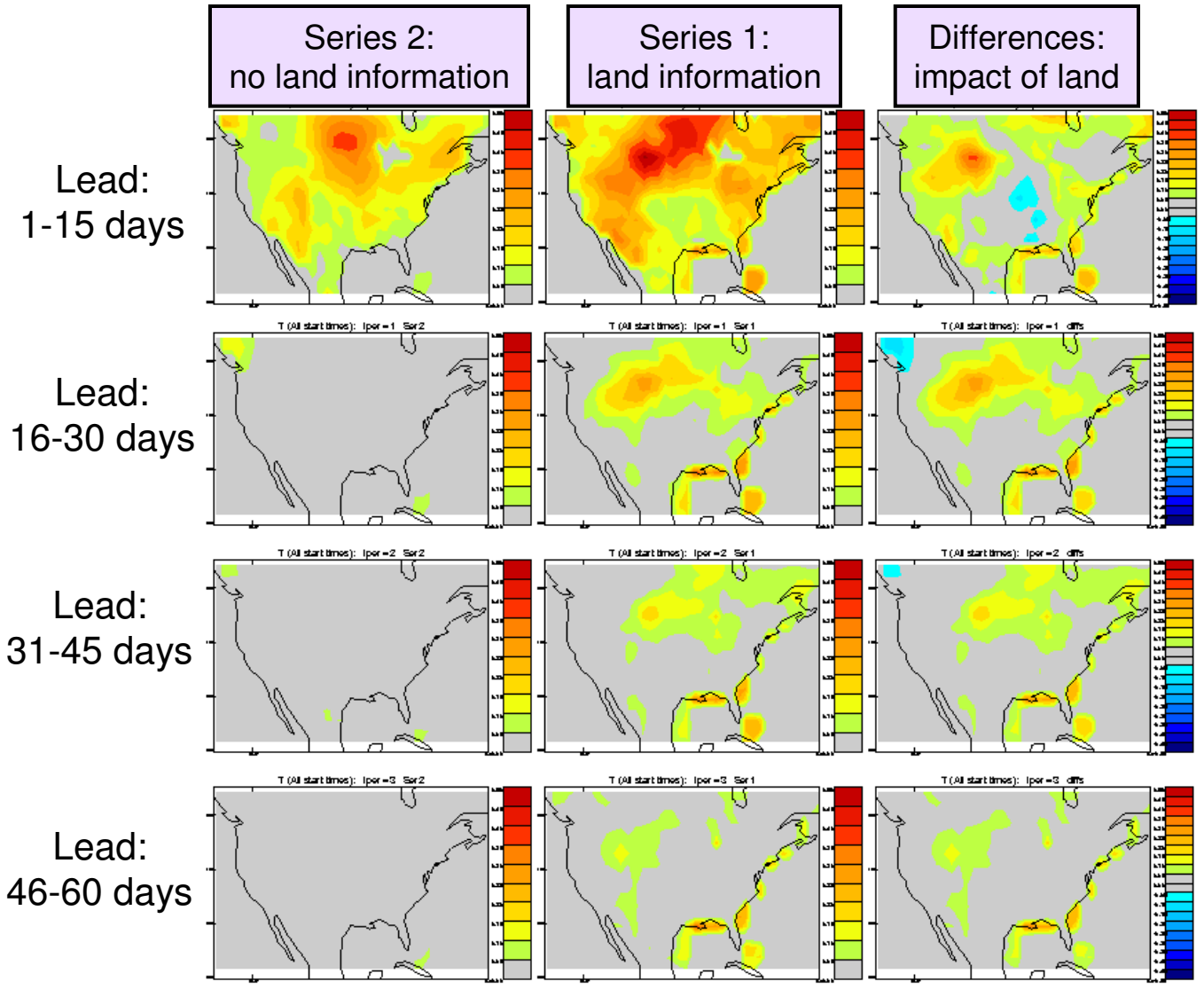
Forecast skill (COLA): Temperature

Raw results,
all start dates



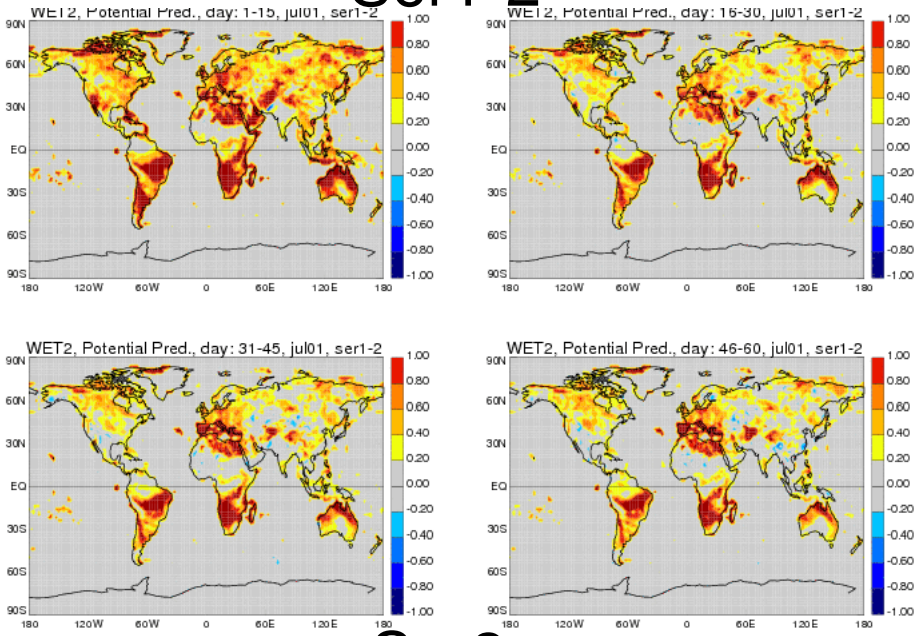
Fcst. Model	*Points of Contact*	*Progress to Date*
NCAR (USA, via U. Gothenburg, Sweden)	Jee-Hoon Jeong	-- *Baseline set of simulations for the period 1986-1995 is finished (Series 1 and Series 2).* -- Performing additional forecasts with modified initialization strategy.

In preparing for this telecon, we found some unusual aspects of the results that need clearing up – we need to talk to Jee-Hoon. Currently, the results for NCAR are indeterminate.

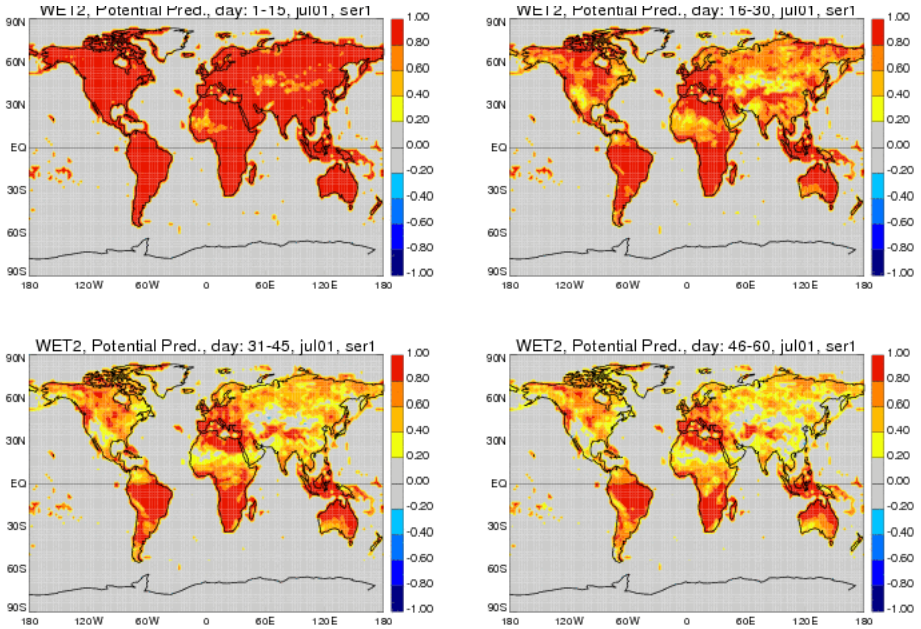
Fcst Model	*Points of Contact*	*Progress to Date*
GEOS5 GCM; NSIPP GCM (NASA/GSFC)	Randal Koster, Tomohito Yamada	-- Simulated 50 years of land surface conditions for initialization -- Ran GEOS5 GCM 10 years to generate climatology -- July 1 forecasts finished.

Model: GEOS5
Variable: SWOI
Start date: July 1
(potential predictability)

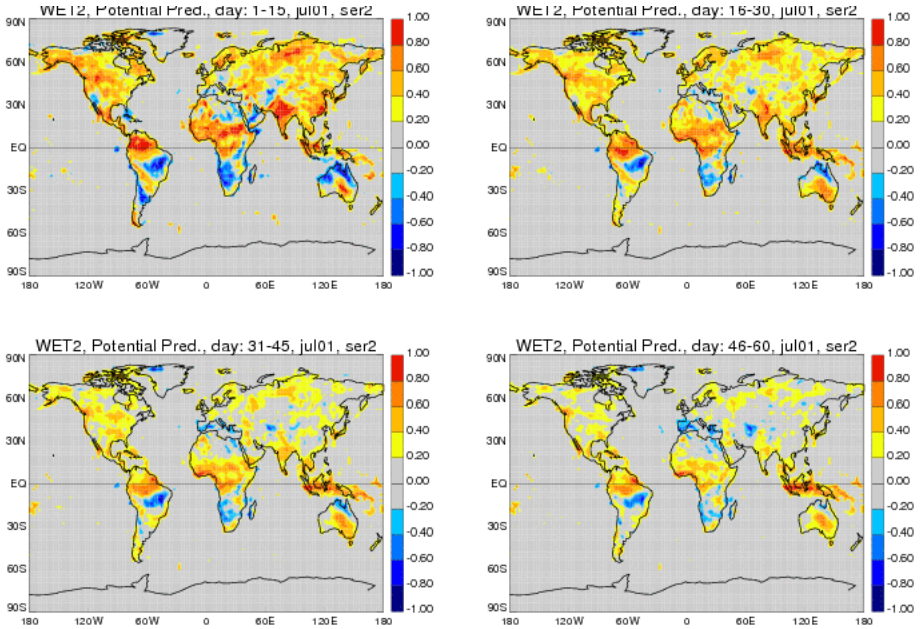
Ser1-2



Ser1



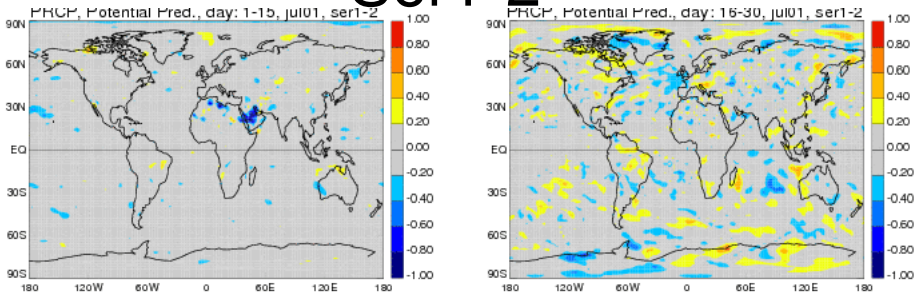
Ser2

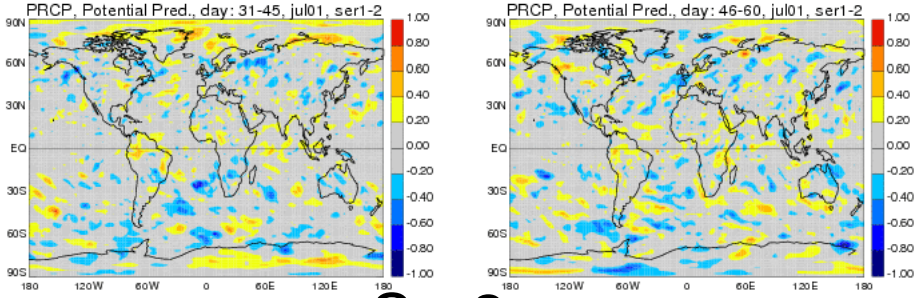


Model: GEOS5
Variable: PRCP
Start date: July 1

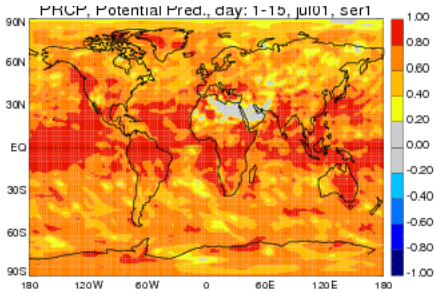
(potential predictability)

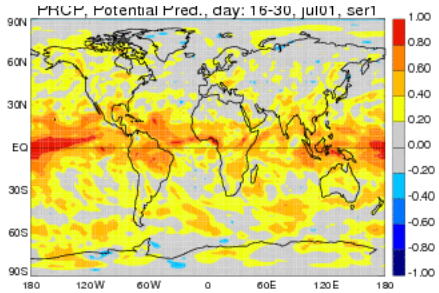
Ser1-2

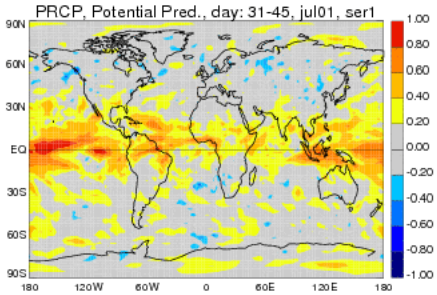


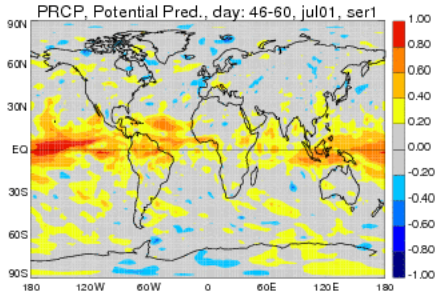


Ser1

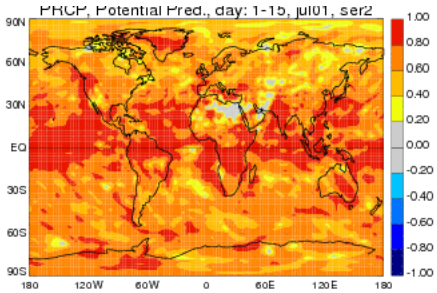


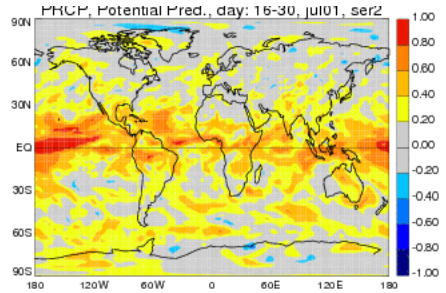


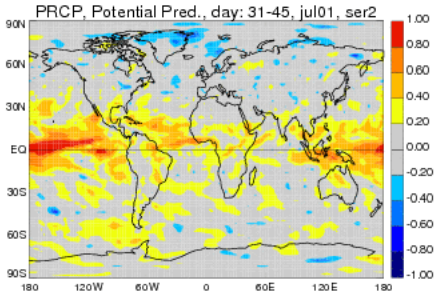


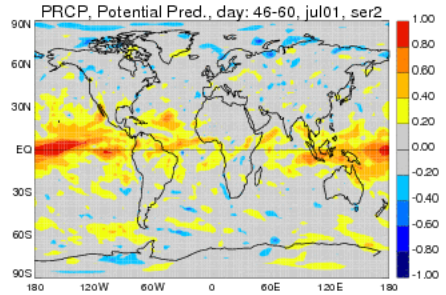


Ser2



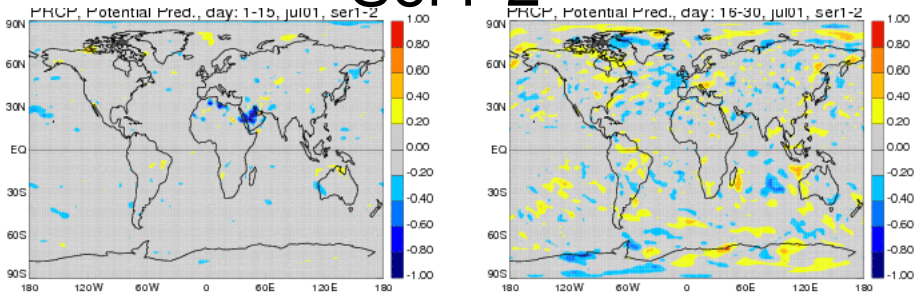


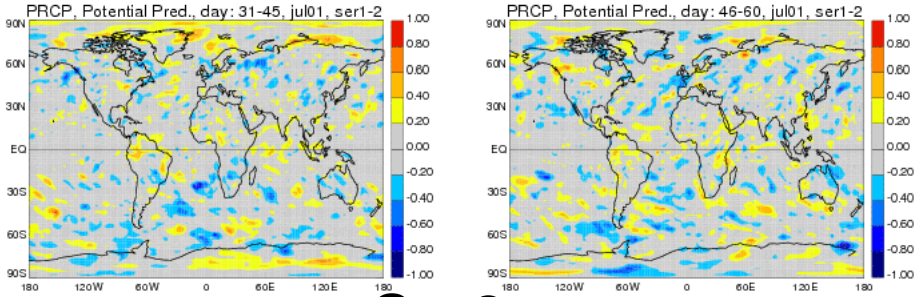




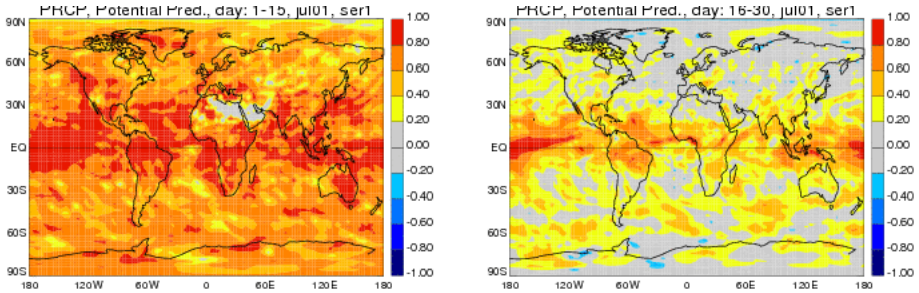
Model: GEOS5
Variable: PRCP
Start date: July 1
(potential predictability)

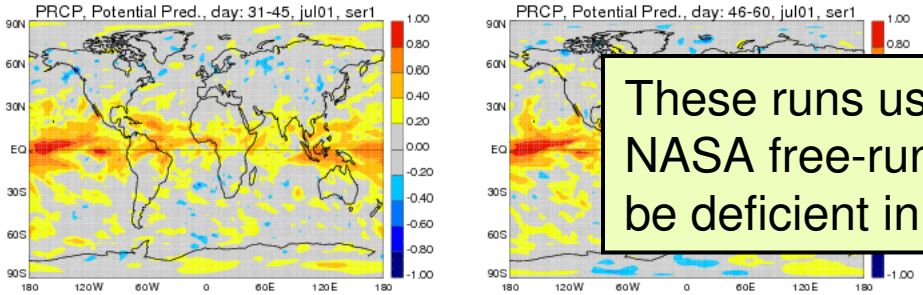
Ser1-2



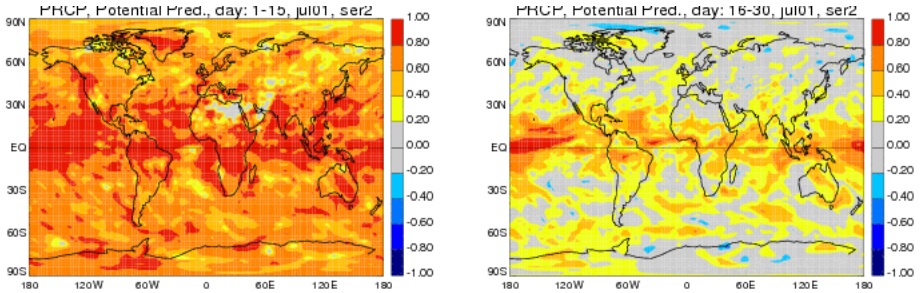


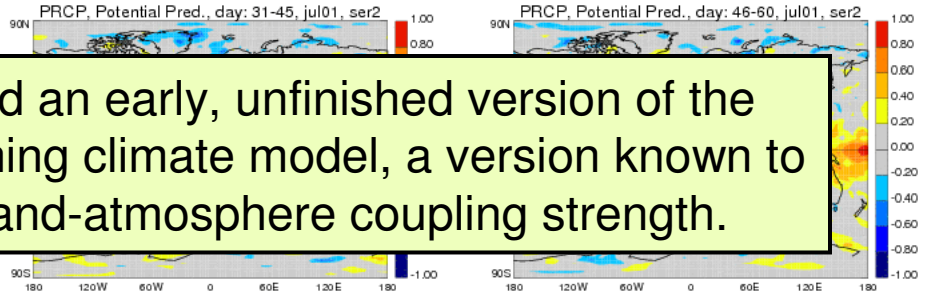
Ser1





Ser2

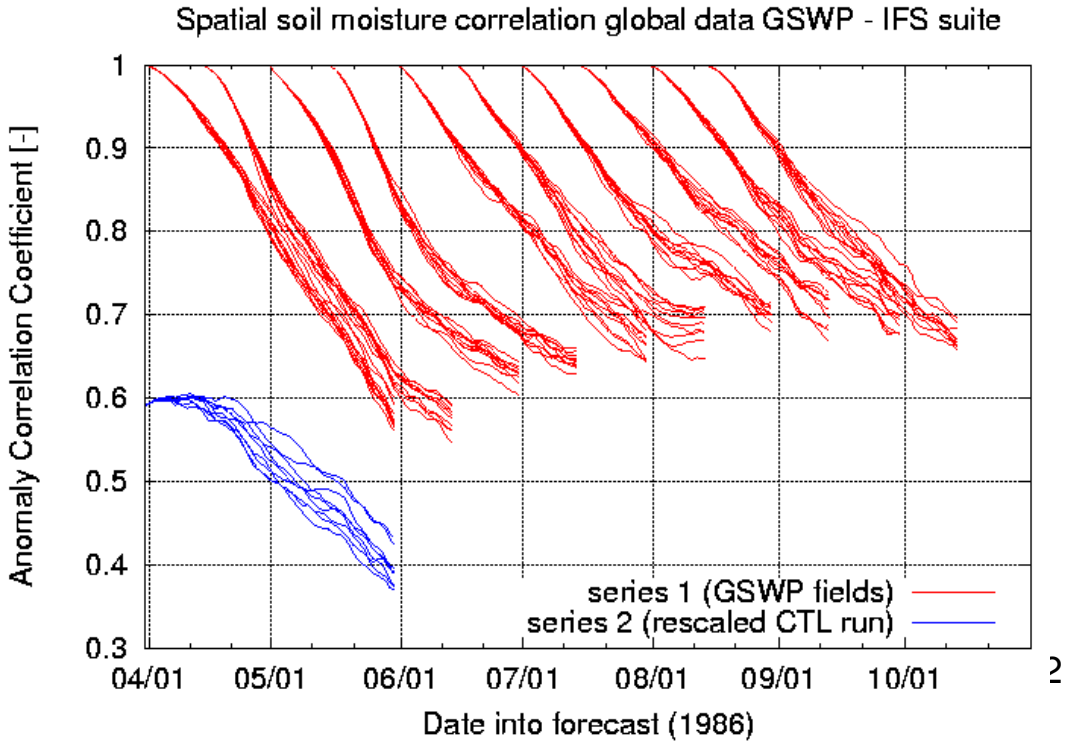




These runs used an early, unfinished version of the NASA free-running climate model, a version known to be deficient in land-atmosphere coupling strength.

Fcst. Model	*Points of Contact*	*Progress to Date*
KNMI	Bart van den Hurk, Helio Camargo, Gianpaolo Balsamo	-- GSWP2 forcings regridded to their GCM's resolution. -- 10-yr climatology run with the GCM, to allow for soil moisture scaling. -- Land model incorporated into LIS, for efficient offline simulation. *-- 1+ years of Series 1 forecasts, 1 set of Series 2 forecasts. (Forecasts are ongoing.)*

First results showing forecasted soil moisture's agreement with "truth" across the globe:
-- decrease of agreement with time
-- agreement differs amongst ensemble members.
-- longer apparent memory in mid-summer



Fcst Model	*Points of Contact*	*Progress to Date*
GFDL (USA)	Tony Gordon	-- AMIP style control run performed for atmospheric initial conditions and for scaling of land variables. -- 10 years (1st of each of month, 10 ensemble members) completed, for both Series 1 and Series 2. -- All Series 1 runs done; scaled and unscaled; Series 2 done two ways: with pdf, and with average.

Fcst Model	*Points of Contact*	*Progress to Date*
NCEP (via Princeton, USA)	Eric Wood, Lifeng Luo	-- Simulated 50 years of land surface conditions for initialization. -- Ready to go; waiting for time on NCEP machine.
ECHAM (via IACS, Switzerland)	Sonia Seneviratne, Roesch Andreas	-- Series 2 simulations for GSWP2 period are finished for most start dates in 10-year period.
ECMWF	Gianpaulo Balsamo	
CCSR/NIES/ FRCGC (Japan)	Tomohito Yamada	-- Simulated 50 years of land surface conditions for initialization.
FSU/COAPS	Marie Boisserie	(New to project)

Discovered: Problem with GLACE2 SST data (Thanks to Tony Gordon for spotting this.)

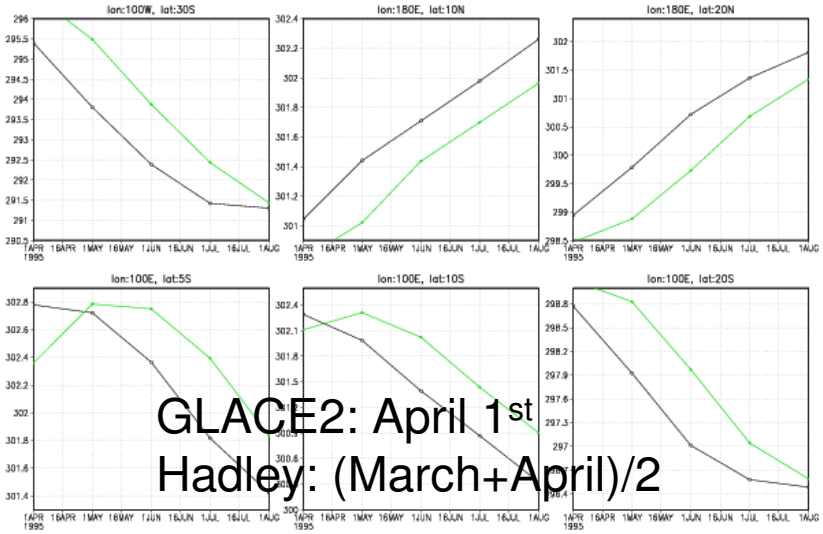
- Original data: Hadley monthly mean state
- Two types of data

  1. start date: 1st (interpolated by two months, e.g., (March+April)/2=April 1st)

  2. start date: 15th (directly from Hadley monthly mean sate at a same month)

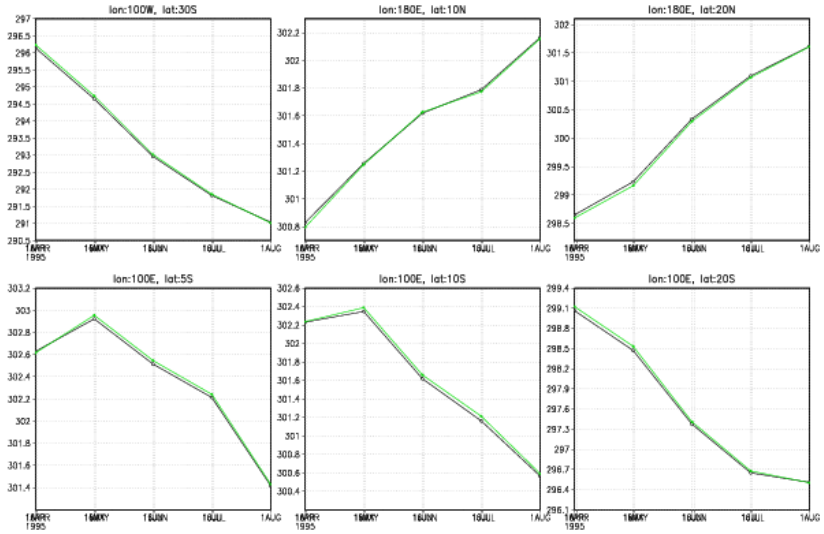
1995, Sea Surface Temperature
GLACE2 (black line) & Hadley (Green line)

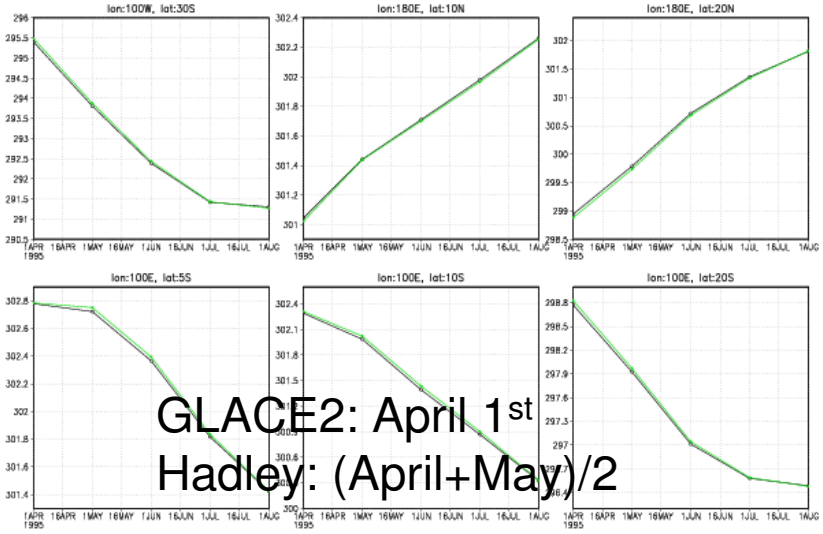
1st simulation



GLACE2: April 1st
Hadley: (March+April)/2

15th simulation





GLACE2: April 1st
Hadley: (April+May)/2

Main point: Somehow, the SST data meant to refer to March 1 actually refers to observations on April 1.

The problem only applies to start dates on the first of the month. SST data for start dates on the 15 of the month are not in error.

New SST datasets are being constructed now.